Conference on Agricultural Research and Extension

CONVENED BY THE

DEPARTMENT OF AGRICULTURE

HON. L. C. HALMRAST
Minister

O. S. LONGMAN
Deputy Minister

ST. STEPHEN'S COLLEGE
UNIVERSITY OF ALBERTA

January 10th, 11th and 12th, 1955

AGRICULTURAL CONFERENCE

St. Stephen's College Auditorium
University of Alberta
Jan. 10, 11, 12, 1955

RESEARCH AND EXTENSION

Province of Alberta
Department of Agriculture

Honourable L.C. Halmrast
Minister

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The conference was opened by Dr. O.S. Longman who welcomed those present and referred particularly to members of Science Service and Experimental Farms attending.

We see changes on the horizon that may affect us in the future, Dr. Longman said. During the past year, Canada has had to assume increased responsibilities as a nation. Our position in the world is a more important one than ever before.

On the purpose of the conference, Dr. Longman mentioned the need to know something about the work of others. A few years ago, he said, it was thought advisable to bring together extension and research so that results might be reviewed, mutual problems discussed, and an opportunity for better acquaintance provided.

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COARSE GRAIN CROPS IN ALBERTA

A.D. McFadden
Experimental Station, Lacombe

I propose to deal with this subject by breaking it down under three main headings. First, we should consider past production trends in order to have a full appreciation of the true value of coarse grain crops as compared with other crops and other farm enterprises. Secondly, it would seem logical that we should attempt to arrive at an appreciation of the actual production potential of oats and barley on Central Alberta soils as compared with wheat. Finally I would like to present the requirements of oat and barley varieties as I see it, with a view to securing suggestions from this group as to how our oat and barley breeding programs can be improved to better meet the needs of the farmer.

In order to appreciate production trends I have referred to the official production estimates in this province during the past 25 years. We all appreciate the rapid increase in wheat acreage shortly after the turn of the century. The following table presents the average annual acreage seeded to wheat oats and barley by five year periods from 1929 to 1953.

Crop	1929-33	1934-38	1939-43	1944-48	1949-53
	Average annual acreage (000's acres omitted)				
Wheat	7,731	7,668	6,945	6,678	6,852
Oats	2,425	2,869	3,022	2,841	2,502
Barley	699	958	1,587	2,071	2,904

It will be noted that using five year periods, Alberta's wheat acreage reached its highest level during the period 1929-33. However, in 1940 there were 8,699,000 acres seeded to wheat which represents Alberta's

highest recorded wheat acreage. In 1941 there was a sharp drop in wheat acreage and from 1941 to 1953 it actually averaged 6,570,000 acres which is approximately 1,200,000 acres less than the annual average for the thirteen year period prior to 1941. These figures indicate a tendency for Alberta farmers to reduce wheat acreage. I would submit that one of the main reasons for this decrease is the inability of wheat to be grown without resulting in a build-up of wild oats in the land.

It will be noted that oat acreage during the 1949-53 period was only slightly higher than the acreage during the 1929-33 period and that a considerable increase in acreage took place during the late 30's and early 40's. A peak of 3,676,000 acres were seeded to oats in 1943 and since that year there has been a general decrease in the oat acreage. Here again, it is quite possible that wild oat infested land has had some effect on this apparent decrease.

The change in Alberta's barley acreage is most striking. While actual production figures show considerable variation in barley acreage from year to year, the general trend would appear to be toward increased acreage. It will be noted that in each successive five year period since 1929 there has been a marked increase in the acreage over the previous five year period. By 1951 Alberta's barley acreage had passed the 3,000,000 acres and in 1953 the actual acreage seeded to barley was 3,489,000. I would submit that this increase is closely allied to the wild oat infested land in this province.

Considering the three crops together, we find that during the period 1949 to 1953 there were 6,852,000 acres of wheat, 2,502,000 acres of oats and 2,904,000 acres of barley seeded annually in Alberta. Thus the oat and barley acreage for this period amounted to 78.9 per cent of the wheat acreage. Annual production for the same period amounted to 139,400,000 bushels of wheat, 99,400,000 bushels of oats and 86,000,000 bushels of barley. Using commercial market prices for the value of the grain we find that the oat and barley production showed a value equal to 84 per cent of the value of the wheat crop. If we consider the amount of oats and barley that is marketed through livestock as compared to the amount of wheat that is fed, it would seem reasonable that the true value of Alberta's oat and barley crop was equal to, or may have surpassed, the value of Alberta's wheat crop. In other words, we are rapidly approaching the time, if we have not passed same, when the oat and barley production will represent a larger share of Alberta Farmer's income than wheat.

Finally, statistics reveal that approximately 75 per cent of Alberta's oats and 82 per cent of her barley is produced in Central Alberta. Since only slightly more than 50 per cent of Alberta's wheat is grown in Central Alberta the coarse grains assume a much more important role in this area and the true value of the oat and barley crops far exceeds the value of the wheat crop.

In view of the importance of these coarse grain crops to Central Alberta farmers, let us now consider some data that will indicate the production potential of wheat, oats and barley. I refer to production potential rather than actual production because these data were compiled by averaging the yields of all commercially grown varieties that were included in comparative rod row trials conducted throughout Central Alberta during the period 1946 to 1952. Average yield data from approximately 35 individual tests, located at strategic points in each of the three major soil zones, are the basis for these comparative figures. In practically all cases the tests were seeded on summerfallow land, plots were hand weeded and the yields were calculated from hand harvested material. Under these conditions, it is assumed that near maximum yields were recorded for the particular set of conditions under which each individual test was conducted.

YIELD POTENTIAL OF WHEAT, OATS AND BARLEY IN CENTRAL ALBERTA
based on rod row results from 1946 to 1952

Soil Zone	Yield of grain per acre					
	WHEAT		OATS		BARLEY	
	pounds	per cent	pounds	per cent	pounds	per cent
2	1744	100	2132	122	2198	126
3	2388	100	2407	101	2602	109
4	1521	100	2036	134	2052	135
	Yield of T.D.N. per acre					
2	1458	100	1524	104	1730	119
3	1996	100	1721	86	2048	103
4	1272	100	1456	114	1615	127

It will be noted that barley outyielded wheat and oats in all zones in both pounds of grain and Total Digestible Nutrients. The excellent performance of the wheat and the lack of good performance of oats on the black soils are worthy of mention. The only possible reason that I can offer as to why the oats and barley did not show up as well on the black soil as it did on the other soils is that it may be attributed to somewhat severe lodging in many of the tests that were conducted on the black soils.

Since these data were secured from small plot tests, with no severe competition from weeds, they must be interpreted with care. Naturally they show a much higher yield than actual production records reveal. However, they indicate production possibilities and it would appear that to increase barley acreage in Central Alberta could only result in increased returns to the farmer providing price differentials between the various grain crops remains equitable.

These past production trends and the yield potential indicate that Central Alberta growing conditions are very satisfactory for the production of the coarse grain crops. Since it is the responsibility of the plant breeding institutions to provide suitable varieties for production by Alberta farmers, we should now consider some of the characteristics that are essential for satisfactory coarse grain production. I propose to consider these briefly under the following headings: length of maturity, strength and length of straw, disease reaction, kernel characteristics, harvesting difficulties, straw quality and grain quality. All of these factors must be considered to end up with the yield of a product which can be fed to livestock or disposed of in the commercial market with a view to netting higher returns per acre for less cost of production.

Length of Maturity - We are not blessed with an extremely long frost-free period in Central Alberta, yet, fortunately, we are able to utilize varieties which offer quite a wide variation in maturity. Long time average maturity data at Lacombe reveal that Olli barley will mature in about 92 days when seeded on summerfallow. By the same comparison Thatcher wheat would require about 122 days and Victory oats would require about 115 days. Past experience has indicated that Thatcher and Victory will reach full maturity without damage from frost in about 50% and 75% of the years respectively. Therefore, I submit that there is a place for both early and late maturing varieties since we find that generally, the varieties which require a longer period to reach maturity possess somewhat higher yield potential. This seems to hold especially true with oats and barley. Long time average yield data reveal that Larain oats will yield about 70% that of Eagle if both varieties reach maturity without damage from early fall frosts. Olli barley can be expected to give about 75% of the yield of Newal under the same conditions.

Each individual farm and in many cases individual fields on a farm has its specific problems. In many cases there are no serious weed problems and in these cases the farmer might be well advised to take advantage of the higher yielding, later maturing varieties to increase his return per acre. Other farms and fields are blessed with many weed problems that can best be met by utilizing the fastest maturing varieties that are available. While

the early maturing varieties do not possess as high yield potential, they do offer higher returns per acre under the above conditions. Finally, farmers operating large acreages may find it advantageous to utilize both early and late maturing varieties in order to allow for better distribution of labor and equipment in seeding and harvesting operations.

Strength and Length of Straw - Strength of straw or lodging resistance must be classed as a characteristic of major importance, especially when oats and barley are grown on the black and gray soils. In some instances yields have been reduced up to 70% because severe lodging has taken place during the early stages of the development of the crop. Lodging in the later stages of development has frequently resulted in severe losses because it is not possible to pick up the crop with our present harvesting equipment.

Lack of straw length has not been a serious fault with many of the varieties presently being grown in Central Alberta. If any criticism can be levelled at plant breeders, it might be for not selecting for somewhat shorter strawed varieties.

Disease Reaction - Up to the present time plant breeding project with oats and barley have concentrated on breeding for resistance to rusts and smuts with only minor consideration for the many leaf diseases. In many years these leaf diseases do not cause serious damage to oat and barley crops. However, we must admit that they have appeared in epidemic proportions in the Central part of this province during the past two growing seasons, and I can assure you that plant breeders and plant pathologists are keeping their eyes open to the importance of these diseases. I am satisfied that future breeding programs will put more emphasis on the importance of these diseases than has been done in the past.

In this connection it is gratifying to know that many barley producing sections on this continent periodically report serious losses from these leaf diseases and that such losses are closely allied to conditions somewhat similar to those growing conditions which persisted throughout most of Alberta in 1954. Fortunately, we do not experience many growing seasons quite like 1954. In normal seasons in this province we do not have too many disease problems that cannot be controlled with seed treatments and proper crop rotations.

I do not feel that I should drop the subject of disease without saying a word about Olli barley. This variety has disappointed many farmers during the past two seasons. A fair percentage of the 1953 crop was very light in bushel weight even though there was no frost damage. Again in 1954 there was a lot of Olli barley harvested before the September frost that failed to weigh better than 40 pounds per bushel. Olli barley is a very sensitive variety in that it does not appear to be capable of withstanding any severe setback of any nature during its growing period. It could be possible that much of the light weight barley is merely the result of unsatisfactory growing conditions. However, I feel that the poor performance of this variety may be attributed to the fact that much of the Olli showed a very high infection with scald in the early stages of growth which completely destroyed the leaf tissue long before its normal dying process. Prior to 1953 there were very few complaints about this variety and I would like to suggest that we as agrologists should be very careful not to condemn this variety on its performance during the past two seasons.

Kernel Characteristics and Threshing Problems - These characters possibly have not been given the consideration they merit. Some of our best varieties, when all other characteristics are reviewed, suffer damage in threshing. Others have a tendency to shatter before they are fully mature. With some varieties of barley it is difficult to remove the awn or the hood from the kernel. The kernel size of Olli has been criticized because it is difficult to remove wild oats in cleaning operations. Larain oats have been faulted by seed growers because of the excessive hulling that occurs at harvest, even when extreme care is taken in threshing or combining. To some growers these characteristics may not be considered of much importance, but to others they are of major importance. Personally, I am of the opinion that large uniform kernels of both oats and barley are very desirable providing other desirable characteristics can be maintained with the large kernels.

Quality of Straw and Grain - Since a considerable portion of straw from oats and barley is utilized as roughage for livestock the feeding value of the straw assumes some importance. However, the grain is by far the more important part of the oat and barley crop and it does not seem feasible to forsake any of the desirable grain qualities in order to bring about a minor improvement in straw feeding quality.

Quality of the grain is important to both the producer and the eventual consumer of same. While the climatic conditions under which the crop is produced have a marked effect on final quality, choice of variety has also contributed materially to the maintenance of high quality grain. If a grower wishes to market his grain as malting barley he must first select a variety that will meet the quality standards that are laid down by the purchasers of his malting barley. As new uses for coarse grains develop, such as the use to which the oriental trade is putting our barley at present, we should strive to produce the variety that offers the best possible chance of giving a product that will prove satisfactory to the eventual consumer. In many cases, the grain to supply special markets is produced under contract. On the other hand, some markets develop which require a sizable quantity of grain which is secured on the open market based on our commercial grades and it should be the endeavour of Alberta farmers to turn out the best possible product in order to attract such markets. All of these factors must be considered in the breeding programs for improved varieties of oats and barley.

As yet, the quality of the coarse grains has not been subjected to the rigid qualifications that have been laid down for those grains that are sold for the manufacture of products used by humans. However, the present thought of many agriculturists is that greater emphasis should be placed on producing feed grain varieties with much higher protein content. This offers a real challenge to the plant breeder and chemist and it is to be hoped that progress along this line will be forthcoming.

Yield - Yield may be listed as the end result of the efforts to secure desirable characteristics in all of the above factors. If a farmer is in a position to take full advantage of Central Alberta's growing conditions without too many serious weed problems, he will probably come close to the maximum yield potential of Alberta soils and climate. If, on the other hand, he faces specific problems which limit his selection of varieties he may possibly reap maximum potential yield for his farm, but it may be somewhat lower than the maximum potential yield for his soil type.

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FEEDING VALUE OF DAMAGED GRAINS

Dr. F. Whiting
Experimental Station, Lethbridge

Feeds may be damaged in one of three ways:

(a) Production or presence of toxic principles

(b) Reduced palatability

(c) Reduced nutritive value

All damaged feeds, unless toxic, have a value as a feed and should not be wasted. The exact value will depend upon the type of damage and the extent of the damage.

Damaged Grains

Frost - Frost, if severe, stops growth of the plant at the stage of growth it was in when frozen. Frost damage reduces digestibility and nutritive value in proportion to reduction in weight per bushel. Frozen grains with the exception of flax are not toxic.

Molds - Molds and mildews reduce palatability of grains but only rarely cause death. They may cause digestive disturbances, especially in horses. Mold growth uses up mainly the starchy part of seed resulting in grain of lowered energy value. The digestibility of the protein is lowered.

Sprouting - Unless extensive sprouting takes place there is little change in feed value. Yield and grade will be reduced by sprouting.

Fire - Fire damage reduces the palatability of the grain. Badly charred kernels are of low feed value. Fire-damaged grain usually contains nails, glass, wood, etc. which must be removed before feeding.

Rust - Rust damage robs kernels of nutrients, resulting in poorly filled grain. Its feed value is similar to frozen grain of the same weight per bushel.

Ergot - Presence of ergot bodies above approximately 1/10 of 1 per cent of the grain makes the grain potentially harmful to feed. Mercurial and other seed treatments are harmful to livestock. Treated seed should not be fed.

Damaged Hay, Greenfeed, and Silage

Frost - This applies usually only to green feed or a grain crop. Severe frost kills the plants which then dry rapidly. The straw becomes brittle and much leaf material is lost in handling. Although no experimental data are available many farmers feel that straw from a severely frozen crop is of lower feed value than that from a non-frozen crop. Frost-damaged green feed is not harmful to livestock. Frozen flax is potentially harmful.

Rust - Rust-damaged green feed and straw from grain crop is similar to frost-damaged green feed and straw. The straw is brittle and less palatable than normal straw. It is not harmful to feed.

Mold - Most molded hays or green feed are unpalatable and may be harmful. Molds and mildews in themselves are usually not harmful but conditions favourable for growth of molds are also favourable for growth of many other organisms. Botulism is one condition that may result from feeding of moldy hay or greenfeed. Horses are most susceptible to molded hay. Sheep are next and cattle are the least affected. Moldy silage should not be fed, although if placed where cattle can pick over it they will usually consume a goodly portion of it without harm. Moldy sweet clover hay or silage should not be fed, or if fed should be fed with the knowledge that there is a considerable risk that the animals will hemorrhage.
When hay molds or heats not only is there a loss in dry matter, in carotene, and in palatability but there is a decrease in digestibility of the protein and energy of the feed. A study carried out in the United States showed the following results.

	Total Digestible Nutrients	Digestible Crude Protein
Good alfalfa hay	56%	14%
Brown alfalfa hay (sweated)	38	3
Black alfalfa hay (heated and molded)	23	0.6

Ergot - The presence of ergot in thrashed straw or mature rye hay etc. is potentially harmful.

Herbicide and Insecticide residue - Most of these chemicals are not harmful to livestock if properly used. It has been reported that 2,4-D increases nitrate content of certain plants. This could result in nitrate poisoning of livestock.

ECONOMIC ASPECTS OF FORAGE CROP ROTATIONS

Gordon Haase
Dominion Economics Division

During the past several years there has been a significant increase in the acreage of forage crops on Alberta farms. Most of this increase has taken place in the black soil and the grey-wooded soil zones. Several reasons have been advanced for this increase in forage crops. On some farms grass has been laid down to control weeds. In other cases the control of erosion has required certain slopes and exposed places to be seeded down. On other farms forage crops are included in the rotation to improve the soil and build up its organic matter content.

Whenever a substantial amount of a forage is produced on the farm, a major change in the organization of farm business is involved. The forage crops that are produced require an assured market on the farm before their value can be realized and this ordinarily requires an increase in the number of livestock that are produced on the farm. It may be noted, at the same time, that a decision to increase livestock production in response to a strong demand for meat may also lead to re-organization of the farm business to emphasize cattle and grass. In this situation forage crop production may arise out of market conditions rather than any physical need for grass in the crop rotation.

A change in farm organization that involves an increase in the production of forage and livestock and a shift away from a straight grain and summerfallow practice has many important implications. At the farm level this ordinarily involves increased investment, higher output per farm and a higher and more stable farm income.

Government agencies concerned with conservation and desirable land use have long recognized forage crops as contributing to these goals. Other government agencies concerned with marketing are interested in the increasing amounts of livestock products that enter the local and interprovincial meat marketing channels. In view of this wide interest in forage crop production, the Economics Division of the Canada Department of Agriculture made an intensive study in 1954 of a small group of twenty farms whose organization was based mainly upon livestock production and a consistent programme of forage crop production. For purposes of comparison another group of twenty farms, similar in size and soil conditions but emphasizing a straight grain and summerfallow rotation, were studied at the same time. The two groups of farms were then compared to show the main differences in cropping practice, livestock enterprise and income characteristics that are associated with each type of farming. The comparison is limited by the relatively small size of the groups of farms in each case, and further that the study is concerned with only the year 1954 which in certain respects was not typical of long run experience.

Land Use

All the farms included in this study were half-section in size. The forage farms on the average had 276 acres of improved land per farm while the grain and fallow farms had an average of 270 acres per farm. For purposes of convenience, the group of farms emphasizing forage crops are designated in this study as forage farms, although they grew a substantial acreage of field crops. On the other hand, the farms emphasizing grain crops and summerfallow, which are designated here as fallow farms, nevertheless had a small amount of forage crops included in their cropping system.

The following table shows the acreage of the main crops and hay for both groups of farms, together with the yield of each crop per acre in 1954. Three features of the cropping practices of these farms may be noted especially. In the first place, the forage farms had less acreage in cereals than did the fallow farms, but the yield and total output of grain was greater from this smaller acreage on the forage farms. Secondly, the acreage under hay and pasture on the forage farms was about 117 acres in 1954 as compared with only 15 acres per farm on the fallow farms. Finally, the fallow farms had almost

100 acres per farm under summerfallow and producing no crop in the year under review, while the forage crop farms had less than 30 acres idle and in this unproductive condition in that year.

Table 1. Crop Rotation Study 1954

	Land Use	
	Forage Farms - acres -	Fallow Farms - acres -
Wheat	6 (15.1 Bu.)	22 (10.0 Bu.)
Oats	43 (32.7 Bu.)	50 (23.1 Bu.)
Barley	79 (23.6 Bu.)	84 (19.9 Bu.)
Flax	0 -	2 (4.0 Bu.)
Alsike	2 (144 lbs.)	0 -
Hay	64 (1.35 ton)	6 (1.0 ton)
Grass and Sod Breaking	16 (0.85 ton)	0 -
Pasture (tame)	37	9
Summerfallow	28	96
Breaking	1	1
Total Acreage Cultivated	276	270
Total Assessed Acreage	319	316½

Livestock Enterprise

The greater production of feed on the forage farms in accompanied by a correspondingly larger livestock enterprise. The following table shows the numbers of the main kinds of farm livestock on the forage crop farms in comparison with the same livestock on the fallow farms. The main difference will be noted in the cattle enterprise with a total of 40 head per farm on the forage farms as compared with 12 head per farm on the fallow farms.

Table 2. Livestock Numbers - (Fall, 1954)

	Forage Farms	Fallow Farms
Horses	1	1
Dairy Cows	4	2
Beef Cows	10	3
Bulls	1	0
Calves	13	4
Other Cattle	12	3
Sheep	5	0
Sows and Boars	5	4
Other Hogs	51	30
Poultry	131	63

Farm Income

The income that the farm operators obtained in each of the types of farming studied here is the main significant factor determining possible shifts from one type to the other, since farmers will adopt the more profitable practice as soon as they are aware of it and are able to make the change. The following table shows the farm income from the forage and livestock production as compared with farm income from straight grain farming from these farms in 1954, together with a further calculation of labour income which is the returns to the operator for his work in management after all the farm

expenses have been paid and interest has been allowed on the money that has been invested in the farm business. In the income figures as shown, two main features may be noted. In the first place the livestock sales from the forage farms exceeded the livestock sales from the fallow farms by some $3,400. This advantage was offset by $1,000 more cash expenses on the forage farms and by about $550 crop sales from the fallow farms. In terms of farm income however, the forage crop farms averaged $2,810 per farm in the year under review as compared with $562 per farm for the fallow farms in that year. When interest on farm capital is taken into account, our study indicates that the operators of the forage farms receive an average of $941 for their labour and management whereas, after making provision for interest on farm capital, the farm income on the fallow farms failed by $800 to make any return to the operator for his labour and management.

Table 3. Crop Rotation Study - 1954 - Average Per Farm

	Forage Farms - $ -		Fallow Farms - $ -	
Field Crop Sales	679		1,214	
Net Livestock Sales	5,135		1,748	
Livestock Product Sales	660		72	
Misc. Farm Receipts	69		21	
TOTAL FARM RECEIPTS		6,543		3,055
Cash Operating Expenses	2,519		1,517	
Depreciation	1,214		976	
TOTAL FARM EXPENSES		3,733		2,495
Farm Income		2,810		562
Interest on Farm Capital		1,869		1,362
		941		-800

Farm Capital

The production of livestock and forage crops is a more intensive type of farming than the production of field crops together with summerfallow. This increased intensity is reflected in higher investment per farm in real estate, livestock and equipment as well as in higher cash operating expenses and in a somewhat higher labour input. The following table indicates that the total investment in these forage farms in 1954 was over $37,000. This was about $10,000 more investment than the fallow farms contained. The forage farms had a higher real estate value which was mostly represented in more farm buildings since the land values were similar for both groups of farms. There was about $4,000 more invested in livestock and $2,500 invested in machinery on the forage farms in 1954 as compared with the fallow farms in the same year.

Table 4. Crop Rotation Study - Farm Capital

	Forage Farms - $ -	Fallow Farms - $ -
Real Estate	22,837	19,065
Livestock	5,825	1,864
Equipment	8,715	6,305
Total	37,377	27,234

Farm Perquisites

Part of the income which the operator and his family receive from farming is represented by the values of produce which the farm supplies to the family. In the case of the forage farms and fallow farms included in this study, it appears that the families on the forage farms obtained greater amounts of livestock products and garden produce as a contribution to their living than did the families on the fallow farms. At the same time, the families on the forage farms lived in better houses on the average than did the families on fallow farms. The following table shows the approximate values of the items that these farms provided to the families living on them during the period of the study.

Table 5. Crop Rotation Study - 1954 - Farm Perquisites

	Forage Farms	Fallow Farms
	- $ -	- $ -
Milk	77	65
Cream	59	24
Butter	73	24
Eggs	60	32
Garden produce	73	60
Meat	121	71
TOTAL	463	276
House (10% of present value)	384	207
	847	483

LIVE STOCK INSECTICIDES

R.H. Painter
Science Service, Lethbridge

An attempt to clear up some of the confusion existing today in the multitude of live stock insecticides now on the market was explained by Mr. Painter. It is difficult for the ordinary man to know what is in these chemicals, he said, and many of them are toxic to animals and people.

The speaker indicated the value of a manual for use of extension workers - a type of manual that would tell them what the chemical is, what it is good for, what the symptoms of poisoning are and how to counteract the poison. The good news was that effort has already been directed towards a manual of this kind and that it may soon be ready for release.

Speaking of the contents of the manual, Mr. Painter said that the trade name of the insecticide will be indexed and beside it will appear the common name. From there, the reader will be able to trace the chemical name and the chemical formula, a history of the insecticide, and a brief statement as to its manufacture.

Physical, chemical and biological properties will be noted and with each formulation will appear mention of the caution to be observed in its use. Symptoms that develop in both man and animals from an overdose of any of these insecticides will be explained and the antidote provided where possible. A chart will show the chemicals that can be added to others with safety, those that may be added with caution, and those that cannot be mixed at all.

This suggestion of a manual was received with approval by the conference, and Mr. Painter was commended for his energy and initiative in making this worthwhile contribution possible.

ANHYDROUS AMMONIA AS A FERTILIZER

G.C. Russell
Experimental Station, Lethbridge

Introduction

In Alberta, we are interested in nitrogen fertilizers because of indications that more nitrogen is needed on many of our crops throughout the Province. When considering nitrogen sources, one material that comes to mind, because of recent sensational publicity, is anhydrous ammonia. This material has been used as a fertilizer in the United States for many years, but the amount used has increased greatly in recent years, primarily because of its relatively low price. Considering the fact that anhydrous ammonia is manufactured from coal, air and water or from natural gas, air and water, all of which are abundantly available in Alberta, a favourable price relationship should exist here also. If such is the case, then serious consideration should be given to the use of anhydrous ammonia as a source of nitrogen for agricultural production in Alberta.

Properties of Anhydrous Ammonia

Anhydrous ammonia contains 82 per cent nitrogen. At 80° F. it weighs about 6 pounds per Imperial gallon. Its weight decreases as the temperature increases. It exerts a pressure of about 212 pounds per square inch at 100° F. At this pressure, it is a colourless liquid looking much like water. At normal temperatures and atmospheric pressure, it is a colourless gas with a characteristic odour. The gas has toxic and irritating properties, but, because of its characteristic odour, warning is usually sufficient to allow escape from the danger area before too much damage is done.

Anhydrous ammonia will not corrode iron or steel, but will react rapidly with copper, silver, and zinc, and their alloys. It is recommended that only iron or steel be used in ammonia fittings and equipment.

Advantages and Disadvantages

Some of the advantages involved in using anhydrous ammonia as a fertilizer are: (1) it is relatively cheap; (2) ammonia is readily absorbed by soil and is not easily lost by leaching (making fall application practical when desired); and (3) under proper conditions ammonia is converted readily to the nitrate form, which is preferred by most plants.

Some disadvantages are: (1) germinating seeds are usually killed by contact with this material; (2) the initial outlay for storage and applying equipment is high; (3) there is some danger in handling; and (4) an extra operation is necessary when nutrients other than nitrogen are needed.

Methods of Application

Ammonia may be applied in irrigation water. The gas is allowed to enter the water at a rate which will give a concentration not exceeding 100 parts per million of ammonia in the water. Concentrations above this maximum will cause burning of the crop. Care should be taken in applying ammonia through sprinkler systems since large losses to the atmosphere may occur.

The anhydrous ammonia may be applied directly to the soil. Special equipment has been constructed for this purpose, but various types of machinery such as blade cultivators, chisel ploughs, and heavy-duty cultivators have all been adapted to make these applications. The material should be applied 4 inches or more deep to prevent loss of ammonia to the atmosphere. For the same reason, the soil should not be worked for a few days after application.

Results

There have been only a few experiments concerning the use of anhydrous ammonia in Alberta. Therefore, results from other areas will be discussed briefly to supplement the information available for our conditions.

(1) A great deal of information is available concerning the use of anhydrous ammonia in the Southeastern United States. However, because of the extreme differences in climate and soil in relation to our conditions, their results will not be discussed. Their general conclusion was that results from the use of liquid ammonia or from the use of solid nitrogen fertilizers under favourable conditions were not greatly different.

(2) Minnesota conducted tests in 1953, comparing the effect of anhydrous ammonia applied 4 inches below the soil surface, and of ammonium nitrate broadcast on the surface. These materials were applied at rates giving the same nitrogen level on corn and oats. Some of their results are summarized in the following tables:

Table 1. Effect of applying nitrogen as anhydrous ammonia and as ammonium nitrate on the yield of oats in 1953, Minnesota. (Av. yields from duplicate plots at four locations.)

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	bu./acre
Ammonium nitrate	40	3.9
Anhydrous ammonia	40	2.9
Ammonium nitrate	80	2.5
Anhydrous ammonia	80	7.6

Table 2. Effect of applying nitrogen before planting as anhydrous ammonia and as ammonium nitrate on the yield of ear corn in 1953, Minnesota. (Av. yields from triplicate plots at four locations.)

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	bu./acre
Ammonium nitrate	50	13.6
Anhydrous ammonia	50	13.0
Ammonium nitrate	100	6.7
Anhydrous ammonia	100	15.1
Ammonium nitrate	150	16.5
Anhydrous ammonia	150	12.2

Table 3. Effect of nitrogen sidedressing with anhydrous ammonia and ammonium nitrate on the yield of ear corn in 1953, Minnesota. (Ave. yields from duplicate plots at three locations.)

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	bu./acre
Ammonium nitrate	40	3.8
Anhydrous ammonia	40	8.2
Ammonium nitrate	80	13.3
Anhydrous ammonia	80	10.8

Protein content of the corn and oats also increased as the yield increased. When additional phosphorus and potash were applied, yields were increased slightly more, with the differences in yield due to the source of nitrogen becoming even less pronounced. They concluded that anhydrous ammonia appeared to have a fertilizing value approximately equal (pound for pound of nitrogen) to that of ammonium nitrate on the yield and protein content of corn and oats.

(3) Anhydrous ammonia is used extensively in Washington and Oregon. The results of one experiment in Washington are summarized briefly in the following table:

Table 4. Effect of different sources and placement of nitrogen on yield of fall wheat on trash fallow in 1951, Washington. (Av. yields from two locations.)

Nitrogen Source	N Applied	Method of Application	Av. Yield Increase Over Check
	lb./acre		bu./acre
Ammonium sulfate	20	Broadcast	0.9
Calcium nitrate	20	Broadcast	4.1
Ammonium sulfate	20	Placed	6.6
Calcium nitrate	20	Placed	7.6
Anhydrous ammonia	20	Placed	6.7
Anhydrous ammonia	40	Placed	8.8

The Washington workers conclude, on the basis of these results and similar results from other experiments, that at equivalent rates of nitrogen these materials are equally effective in increasing yields when placed in the soil below crop residues.

(4) In Alberta, the first experiment with anhydrous ammonia was put out on sugar beets in 1952. There was no comparison with dry fertilizer. The ammonia was applied through a sprinkler irrigation system. The application was late and slight burning of the leaves occurred. Top growth on the plots receiving nitrogen was heavier than on the check plots at harvest time, but no increases in root yield resulted from the ammonia applications.

In 1954, a number of tests were started in Southern Alberta, comparing the effect of anhydrous ammonia applied about six inches below the soil surface with the effect of solid fertilizers broadcast on the surface. The results are summarized in the following tables:

Table 5. Effect of different sources of nitrogen on yield of spring wheat on stubble in 1954, Blood Indian Reserve, Alberta. (Av. yield from two locations.)

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	bu./acre
Ammonium nitrate	67	7.3
16-20-0	64	8.3
Anhydrous ammonia	60	1.9

Table 6. Effect of different sources of nitrogen on yield of barley on stubble in 1954, Chancellor, Alberta.

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	bu./acre
Ammonium nitrate	67	5.3
Anhydrous ammonia	67	3.6

Table 7. Effect of different sources of nitrogen on yield of Intermediate wheat grass hay in 1954, Spring Coulee, Alberta

Nitrogen Source	N Applied	Av. Yield Increase Over Check
	lb./acre	tons/acre
Ammonium nitrate	66	0.35
Anhydrous ammonia	60	0.21

Other experiments in 1954 tested the effect of anhydrous ammonia on yield, but were without a suitable check against solid fertilizer. Ammonia on winter wheat in the Warner district did increase yields slightly. However, at Taber, the use of ammonia on canning corn did not result in increased yields.

The limited results in Alberta have indicated that anhydrous ammonia, at comparable rates of nitrogen, gives almost as good results as solid nitrogen fertilizers.

Summary

1. Where nitrogen alone is needed as a fertilizer, anhydrous ammonia will give results comparable with those obtained from solid nitrogen fertilizers in most cases.

2. The major consideration in the choice of the nitrogen fertilizer is, therefore, the cost of the applied material.

3. In calculating the cost, the following points should be considered:

   (a) Cost per pound of nitrogen.

   (b) Cost of application.

   (c) Cost of special storage or applying equipment if needed.

(d) Cost of applying other essential elements, such as phosphorus and sulphur where necessary.

References

1. Anderson, M.S. Liquid ammonia as a fertilizer. B.P.I.S.A.E., U.S.D.A., Beltsville, Maryland. 1948

2. Andrews, W.B., J.A. Neeley and F.E. Edwards. Anhydrous ammonia as a source of nitrogen. Miss. Agr. Exp. Sta. Bull. 482. 1951

3. Jackson, T.L., H.M. Reisenauer and G.M. Horner. Nitrogen recommendations for wheat production in Eastern Washington. Wash. Agr. Exp. Sta. Circ. 179. 1952

4. MacGregor, J.M. Effect of nitrogen on yield of protein of oats and corn. Minn. Agr. Exp. Sta. Misc. Rept. 22. 1954

NITROGEN FERTILIZERS OR LEGUMES?

Dr. C.F. Bentley
Department of Soils, University of Alberta

The summary on the following page of field scale fertilizer trials using nitrogen on combined fields reveals several important points:

1. There was little difference between the various nitrogen fertilizers with the possible exception that results from calcium cyanamid were not quite as good as those for other fertilizers. The slightly better results from 16-20-0 may be attributed to the phosphorus supplied in addition to the nitrogen by that fertilizer.
2. Results were highly variable. Between 1/3 and 1/2 of the trials showed yield increases which were profitable. In some cases very highly profitable yield increases resulted.
3. Great variability of results on adjacent farms with more or less similar periods of cultivation and of cropping history was encountered several times.

The following section represents an attempt to explain why nitrogen fertilizers may be needed in parts of Alberta. These estimates are based on a black soil. Some variations would apply in thin black or dark brown soils but the same principles would apply. In grey soil areas straw decomposi-

Summary of Nitrogen Fertilizer Trials on Combined Fields 1949-54

(Conducted by Soil Science Department, U. of A.)

Crop	Check yield	Yield increases for various fertilizers									
		Ammonium nitrate		Ammonium sulfate		Calcium cyanamid dust		Calcium cyanamid granular		16-20-0	
		Rate of application in pounds of nitrogen per acre									
Barley		33	67	21	33	5-16	16	33	67	33	
Average	31.9	5.3 bus.	9.2 bus.		5.6 bus	0.5 bus.		4.6 bus.	5.8 bus.	6.7 bus.	
No. of farms	33	31	7		22	17		23	7	18	
Increases over 6 bus		11	4		9	0		7	4	12	
Largest increase		18.2 bus.	20.2 bus.		15.6 bus.	5.8		12.5 bus.	18.9 bus.	17.5	
Wheat											
Average	27.5	5.7 bus.	15.7 bus.		2.4 bus.	2.3 bus.	5.0 bus.	1.0 bus.	14.2 bus.	1.9 bus.	
No. of farms	9	9	4		5	8	4	5	4	5	
Increases over 6 bus		4	4		2	2	3	1	3	1	
Largest increase		14.5 bus.	21.9 bus.		14.1 bus.	9.8 bus.	9.2 bus.	10.5 bus.	20.9 bus.	13.5 bus.	
Oats											
Average	39.2	12.9 bus.	39.0 bus.	6.1 bus.	5.3 bus.	2.6 bus.	4.6 bus.	9.4 bus.	33.3 bus.	3.8 bus.	
No. of farms	11	7	2	3	5	6	5	4	2	3	
Increase over 6 bus.		6	2	1	2	2	1	3	2	2	
Largest increase		27.3	41.3 bus.	7.3 bus.	17.7 bus.	8.4 bus.	9.0 bus.	19.1 bus.	42.9 bus.	11.3 bus.	

tion would require similar amounts of nitrogen but even greater variation would be likely in the amount of nitrogen released by decomposition of organic matter already in the soil.

Table 2.

Rough Approximate Estimates of Possible Nitrogen Relationships In an Alberta Black Soil

1. A Black soil with 0.4% N contains in surface 6 2/3" 0.4% of 2,000,000 = 8,000 lbs. N.

2. For 25 bushel crop: in 25 bus. grain 45 lbs. N
in 3,000 lbs. straw 15 lbs. N

60 lbs. N in total crop.

3. Decomposition of part of the organic matter in the soil releases N for crops.

In corn states of the United States, amount so released ranges from 0.6 to 1.25% of the nitrogen in the cultivated layer when grains are grown.

Alberta is cooler, drier and shorter seasoned. Estimate 0.4 to 1.0% of soil content.

0.4% of 8,000 = 32 lbs. N released by decomp. O.M.
or 1.0% of 8,000 = 80 lbs. N released by decomp. O.M.

(These figures vary with kind of soil, years cultivated, crop history, erosion, etc.)

4. In 3,000 lbs. straw: About 1,200 lbs. C
about 15 lbs. N C/N ratio = 80 approx.

In the O.M. of soil: C/N = 10 approx.) guess 3/4 original C
In the bodies of: fungi C/N = 10 approx.) off as CO_2 and that 1/4
actinomyces C/N = 6 approx.) of C of original straw
bacteria C/N = 5 approx.) ends up in soil in these forms with C/N ratio of 8.

1/4 of 1,200 = 300 lbs. C from straw in soil after decomp. and contains 37 1/2 lbs. N if C/N = 8.

i.e. 37 1/2 lbs. of nitrogen are required to decompose the straw.

5. Nitrogen required in this field if combined:

for straw decomp 37 1/2 (a conservative figure)
for 25 bus. crop 60

97 1/2 (probably low)

6. Nitrogen available:

	contained in straw	from O.M. decomp.		Total
1.	15 lbs.	0.4% basis	32 lbs.	47 lbs.
2.	15 lbs.	1.0% basis	80 lbs.	97 lbs.

From the foregoing it appears reasonable to expect that in some Alberta combined fields there may be a serious lack of available nitrogen for crop growth. In fact, these estimates show that it is likely that some soils will supply insufficient nitrogen for good crop growth even if straw is removed. These estimates also support the Alberta Fertilizer Committees recommendation that if nitrogen fertilizers are to be tried by farmers, 40 to 60 pounds per acre of nitrogen should be applied in order to ensure that

enough to meet the needs for decomposition and the growing crop is supplied.

It is difficult to assess the role of legumes in the nitrogen economy of black soils because the amount of nitrogen fixed by the legume bacteria will vary being greater in those soils where organic matter decomposition is releasing the least amount of nitrogen. On a sulphur deficient grey soil such as Breton where data for yield increases and the nitrogen content of crops and soils is available on a long time basis reasonably accurate estimates of nitrogen fixation have been made. On the basis of the following estimates it would appear unwise to replace legumes by commercial nitrogen fertilizers in similar grey soil areas. Certainly some very definite cases of crops on black soil being strongly benefited by previous growth of legumes have been recorded.

In addition to the nitrogen relationships involved possible beneficial effects of deep penetration by legume roots should be considered.

Table 3.

Some Possible Nitrogen Relationships Involving Legumes in Alberta

1. "Sweet clover green manure fallow"

   A. 1 ton sweet clover contains about 50 lbs. N.

   B. Decomposition might release 35 lbs. to 1st following crop.
      Decomposition might release 15 lbs. to 2nd following crop.

   NOTE: The 50 lbs. of N in the sweet clover would come from:

      A. Fixation by legume bacteria.
      B. Nitrogen released by decomposition of O.M. in soil.

2. Breton rotation is: 2 years legume hay, then wheat, oats, barley.

   A. Average yield of hay for each of 2 hay years is 2.3 tons (good plots).

   B. Estimated on 25 year data that 300 lbs. of N are fixed per 5-year cycle.

      200 lbs. contained in hays removed.

      100 lbs. released by decay and used by cereals.

   NOTE: At present prices, fertilizer nitrogen costs about 13¢ per pound of N although there is a prospect of price decrease.

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CULTURAL PRACTICES IN THE CONTROL OF COMMON ROOT ROT

Dr. L.E. Tyner
Science Service, Edmonton

Common root rot is caused by two pathogens in particular, Helminthosporium sativum and Fusarium culmorum. The first of these is the more important. It is a dark colored fungus that lives in the soil and preys upon some of our cereal crops that are planted therein. F. culmorum is one member of a large family, many of which attack the cereals, but this particular member is the most widely distributed among cereals and causes the most damage.

Common root rot causes a brown discoloration of the roots and crown, and can be most readily determined by pulling up the plant, especially the wheat plant, and observing the subcoronal internode, which is the tissue at the base of the crown between the old seed piece and the crown. Early in the season brown blotches may occur on this tissue, which in a healthy plant

is shiny white. Common root rot should be distinguished from take-all, which causes a jet black discoloration of the crown and roots and kills not only the grosser tissues near the crown but all the secondary and primary roots as well. Such a plant shows a white head in the field, with little or no seed, and pulls up with scarcely any resistance at all, since the roots are dead and break off at the slightest pressure.

Common root rot is found in all soil types in this province, and in all kinds of soil - silts, clays, sandy soils, and in those rich in humus. The fungi send a network of mycelium, which are thin threads very much like the roots of a large plant, in that they seek food for the fungus. The mycelium threading its way through the soil reaches the cereal crops therein and establishes itself on this new supply of food. The threads penetrate the plant and derive nourishment from it. Soon a portion of the mycelium will come to the surface of the plant and produce a crop of spores, which are similar to the seeds of higher plants. These spores are blown off and disseminate the pathogen widely. Thus, during the growing season the spores establish themselves on the leaves and heads of the growing crop and a severely infected crop will show seed with black points. This is particularly noticeable in the case of wheat. In barley the whole seed may be blackened. Such seed planted in infested soil without the benefit of seed treatment will infest the soil with the organisms.

Damage caused by common rootrot

At the Saskatoon laboratory it was determined between the years 1941 and 1953 that there was a gradual increase of 8 to 12% in the incidence of common root rot in the wheat crop. The results at the Edmonton laboratory show a very close relationship to these figures. There was an increase between 1940 and 1954 of 7 to 12%. Also, survey results in recent years have shown more fields that are moderately and severely infected. Such fields assuredly cause great loss to the farmer concerned. It is probable that a field classed as severely infected will yield not more than a 50% crop. In 1942 our survey showed more than half the fields classed as clean, whereas at the present time 15 to 20% only may be so classed.

Actual bushel per acre losses were estimated by the Saskatoon laboratory as 5.1 bushels per acre in the years 1937 to 1947. Dr. Machacek at the Winnipeg laboratory estimated 12% crop loss between 1939 and 1941 in Manitoba. Our estimate in northern and central Alberta would be in the neighborhood of 12% between 1951 and 1954. Dr. Broadfoot, in a paper published in 1934, said that root rots probably caused more damage to the Alberta crops year in and year out than do the rusts and smuts combined. It is probable that this situation still holds, since Alberta is seldom subject to disastrous epidemics of rusts, and although smuts are always with us they are controllable readily with chemical seed dressings.

Etiology of common root rot

Seed injury leads to damage from root-rotting fungi which enter injured seed readily. Mechanical injury during harvest operations should be avoided. Seed treatment, as mentioned above, controls smut diseases and also eliminates root disease mycelium and spores from the surface of the seed. It is unlikely that mycelium and spores beneath the hull, for instance, would survive the period of treatment usually recommended for mercurial dusts, that is, a period of eight days between treating and seeding. Mercurial seed dressings are volatile and the gases penetrate the hulls during this eight-day period. Seed treatment, of course, does not have any effect on root disease organisms that are already in the soil, but if the surface-borne organisms are eliminated it is probable that the resulting seedling is stronger and more resistant to attack from the organisms in the soil in the early stages of growth.

The situation regarding influence of drought on root diseases is far from clear. Drought causes symptoms on the crown and root systems very similar to those observed as a result of root-rot infection. Certainly drought seriously interferes with the formation of the secondary roots, and if the

surface soil is really dry these roots will not develop beyond the stump stage. In such a case the plant is naturally dependent upon the primary root system and if root disease has injured this or the subcoronal internode that leads from the primary roots to the upper plant parts it is obvious that the nourishment of the plant will suffer thereby.

High rainfall has been found to significantly affect yield, especially the rainfall in June and July. Also it is commonly observed that root disease damage is very much reduced in crops that have an adequate supply of moisture during this period. On the contrary, a light rainfall for these two months accentuates damage from root disease.

Dr. Mead, At Saskatoon, in a study of root diseases in barley, found that the greatest damage occurred under conditions that were unfavorable to the host, that is, with high temperature and excessive moisture, or low temperature and scant moisture. He recommended sowing barley in a cool, moist, well aerated soil. Wheat seems to have better adaptation than barley to extremes of temperature and moisture, but, in general, the same conclusions will hold.

Dr. Broadfoot, in 1928, instituted a co-operative five-year experiment on the influence of crop sequence on root rot at various experimental stations and schools of agriculture in Manitoba, Saskatchewan and Alberta. He found that infection rating on wheat was reduced by summerfallow and by an oat crop. The infection was practically halved when these cultural practices were used in the rotation. Barley and wheat rotations, or wheat, wheat rotations led to severe damage.

Dr. Broadfoot found that date of seeding, rate of seeding and packing had little effect on root disease infection. Depth of seeding was of some importance, and slightly more infection occurred under deep seeding practice. Other workers have found that the oat crop is not susceptible to H. sativum, and although the reason for this is not yet clear it is probably tied up with the microbiology of the soil as influenced by the oat crop and the products of its decomposition in the soil. Much work has been done on the effect of the multitudes of other organisms that live in the soil upon the pathogens present.

It has been reported by the Swift Current Experimental Station that appreciably higher yield of wheat occurred on plowing than on surface cultivated fields and less disease was present in the former case. It may be expected that the presence of trash cover would provide a very suitable situation for the sporulation of the pathogens after harvest and during the early summer. Insufficient study has yet been made of this problem and it will be necessary to follow for a number of years a selected group of farms in various areas where plowing and surface cultivation practices are employed. In this way it will be possible to get an answer as to the influence of the trash cover practice on the incidence of root disease pathogens.

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PRESENT STATUS OF CHEMICAL CONTROL OF WILD OATS

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There have been three or four types of approach in studies on chemical control of wild oats in grain crops:

1. Early season treatments with (a) only the wild oats emerged, (b) only the crop emerged.

2. Selective control of established wild oats in an established crop by killing the wild oats or destroying their seed viability.

3. Late season (Post-harvest) temporary soil sterilization.

The first, (a), seems to have the least practical importance but is

nevertheless worth investigating for possible useful leads that may be obtained. It involves early season application of chemicals to burn down or to stunt emerged wild oats before the grain has been sown or very soon afterwards. By not disturbing the soil by cultivation you might reduce the chances of a second stand of wild oats coming up afterwards in the grain from seed that didn't grow earlier. A man might seed his crop into a growing stand of wild oats on summerfallow then spray down the weed immediately afterwards.

There are of course obvious disadvantages. One is that usually some kind of seed-bed preparation is necessary in the spring anyway and if one cultivated down a first stand of wild oats and then waited for a second crop to spray just after seeding time it would be getting rather late. Then, too, there is the cost factor. The contact herbicides or leaf burners are quite expensive. An example is dinitro compound (similar to Sinox) sprayed about one or two pounds per acre with 8 or 10 gallons of Diesel oil. Present costs amount to $5.00 or more per acre. Maleic hydrazide (MH) is an example of a stunter to prevent vigorous growth and heading but it too would be just as expensive used in this way.

The other class of chemicals (1b) falling into this discussion involving early season application of chemicals is the seedling toxicants. The idea is to apply them to the soil surface in a young grain crop to kill sprouting seeds of wild oats without harming the grain plants which are already established. The compound sesin is in this class but again there is a rather narrow range within which to work. Moreover, the chief difficulty with <u>any</u> chemical applied to the soil in the springtime is that there may be insufficient moisture for adequate penetration and activity at the time it is needed. Less frequently the precipitation may be so great as to wash the chemical too far down too fast. Lorne Ebell one of our graduate students has spent considerable time experimenting with a wide variety of chemicals used in the approaches mentioned.

The next method (2) is one which could be of very widespread importance. It involves the selective destruction of established wild oat plants or of their seed viability in a grain crop by means of foliage sprays with growth substances. At this university we have been testing Dalapon, a compound similar to TCA, applied at different rates and dates to oats and flax to see what measure of control can be obtained where there is a wide botanical difference between weed and crop. It is too soon to reach conclusions but the indications are that we must look for a chemical with more effect on the wild oats and less effect on the desirable crop. There has been some success with modifications of this method in crops like peas and sugar beets.

Some very interesting experiments have been done with Maleic hydrazide (MH) applied to wild oats in the milk stage growing with grain crops that have passed this stage. Such treatment with about one pound or less MH is reported not to affect yield of wild oats but does seriously affect their ability to germinate - up to 100% inhibition if everything is just right. Credit for the original work on this special approach to the problem (started two or three years ago) goes to G. Knowles who recently retired from the Central Experimental Farm, Ottawa. This work has been pursued on the prairies by A. Carder at Beaverlodge, D. Brown at Brandon and others. N. Iewis of the Plant Products Division, Calgary, has been co-operating with Mr. Carder on germination tests. As already estimated, the success of this method depends on differences in phasic development between the wild oats and the grain crop. This difference is narrow and critical and probably only useful with early maturing barley and possibly flax. Treatment at the wrong stage may produce only partial effects on germination of wild oats and may adversely affect the quality or germination of the grain. I think it is true that tests have not proceeded far enough to be positive that the wild oat seeds are killed in this way rather than changed in dormancy. In any case it is an important step forward. One would not need to worry too much about germination or even some loss in yield of feed barley if he were being compensated by progressive eradication of wild oats. There is, of course, need for further testing under variable field conditions. On hills or low spots in the field it is conceivable that plants or certain tillers on a given plant may be in the wrong stage at the time of spraying. Then too there is the damage from driving ground equipment through the crop. Aerial spraying might be the answer but it

would also have special problems of co-ordination. The cost of chemical, even at present prices, would not be unreasonable.

As already mentioned an excellent series of tests is underway in charge of Experimental Farms people and before long it should be possible for them to assess the net worth of such MH treatments. By way of summary I think it is correct to say that one of the chief worries seems to be that the comditions may be too critical for widespread practical use. But we shall see!

Finally there is (3) Post-harvest application of temporary soil sterilants with the ideal of killing the wild oats and planting a grain crop the following spring. This method of approach so far as I know originated at the University of Alberta approximately three years ago and has more recently been undertaken by interested commercial concerns and governmental institutions, notably in Winnipeg.

The best chemicals used so far with results ranging from partial to practically complete absence of wild oats in treated areas the following spring are IPC and TCA at rates of about 5 - 20 lb. IPC and 20 - 60 lb. TCA per acre at costs of the order of $10.00 - $20.00 more or less. Some of the best results have been obtained with seedlings of well-dried wild oats which grow quite uniformly without delay. Our best results at Edmonton have been 60 - 75% control on an infestation that was seeded the first year and allowed to shatter naturally the second year. Last fall our experimental area gave way to bulldozing for building expansion.

The workers in Manitoba have a good set of field trials under way this season. They had up to 100% control in some of their seeded plots at the University of Manitoba last year. Dr. Shebeski and Dr. Friesen in co-operation with the Provincial Weed Commission and National Grain Co. have trials on about 10 different field locations this year. This involves TCA and IPC at different rates and with various methods of fall preparation of soil such as burning, discing, packing, etc. There are some additional experiments at the Experimental Stations. Maleic Hydrazide and Endothal and heavy applications of 2,4-D have also been tried. If the difficulties can be removed or minimized to the point where there are predictable satisfactory results this would be a very simple and popular way to handle the problem. One of the main disadvantages showing up so far is the carryover of soil sterility into the spring sowing period with the result that grain has not been established at the normal time on land where sufficient chemical has been used to kill the wild oats. It has still not been settled whether all the oats that fail to grow in natural infestations are killed by fall treatment of the soil with chemical. This is a difficult point to check. Unless the dormant seeds are killed, and unless satisfactory distribution of the chemical can be made on heavy stubble land and unless a crop can be successfully grown the following year it becomes questionable whether the chemical treatment can replace spring cultivation and delayed seeding or ordinary summerfallow.

There is however reason to believe that the future will bring developments in the use of chemicals which will eclipse the successes which have been achieved so far in this rapidly expanding science of chemical weed control.

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APPRECIATION

Appreciation was expressed by Dr. Longman to members of the research institutions for their talks here reported.

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REMARKS BY THE MINISTER

The Minister of Agriculture, Honourable L.C. Halmrast, said that in his travels around the province he had found farmers in reasonably good heart notwithstanding unsatisfactory crop conditions. They are short of cash but have a fair amount of grain in the bins.

There is an appreciable improvement in the general standard of farmers, Mr. Halmrast remarked, due to some extent to the assistance of technical people. There is growing appreciation of the importance of new practices and of the findings of research. Wind erosion has been an important problem in the south but is being controlled by newer machines. The general prosperity of southern Alberta is reflected in the better homes and buildings and fairly widespread electrification. Many suggestions have been made to the Government with a view to assisting the farmers.

Undoubtedly lack of a land utilization program has resulted in some errors in land use and settlement. We hope to have a commission which will be in a position to examine lands and decide on their proper use. Master Farm Families are examples of those who have made outstanding contributions to agriculture and to their communities. It is important to have a goal and then to capitalize on all the opportunities that present themselves, the Minister said. The training in 4-H clubs with the district agriculturist will undoubtedly result in better informed farmers in the future.

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AS I SEE IT

Dr. O.S. Longman
Deputy Minister of Agriculture

From the standpoint of agricultural production, 1954 has been somewhat subnormal compared with the past few years. In Canada and the United States we have a tremendous surplus of grains, and with it we have the situation of countries striving for self-sustenance and increasing production. This striving for self-sufficiency of food supplies throughout the world is important.

When we look across the border some of our farm prices seem low, but in the United States an incentive to produce has been created. They are producing regardless of demand, and marginal lands that should not have been brought under cultivation are being cropped. In Canada we have not followed that system. The whole policy of the Canadian price system has been to protect the industry from disaster, not to establish floor prices on an incentive basis.

We have to look beyond our own little field and see what is taking place around us. The General Agreement on Tariffs and Trade was established in 1947 and Canada took an active part in its establishment. Its purpose is to get countries to agree to tariff reductions and to abide by certain international rules and regulations. The present concessions expire this summer and Canada is exceptionally concerned about the situation. Canada and other countries are trying to have escape clauses that exist in the present agreement closed. The trouble is that everyone wants trade freedom for himself and more restrictions for everybody else. What is going to happen as a result of these treaties is very important to all of us.

India, Pakistan, the Gold Coast and several other areas have attained a status of independence. With this has gone a desire to manufacture and produce many things that had previously been purchased abroad, and a right to impose import restrictions. There again we can well pay attention to what is transpiring. As an exporting country we are very interested in the trade and tariff policies of other countries. One result of the emancipation of these people has been an endeavour to emulate what is taking place in the western world.

Another trend worth observing is the struggle between labour and industry. Industry can pass on to the public whatever it has to pay labour, and we in agriculture stand between. There is tremendous disparity between

the earnings of labour in agriculture and those in industry. It is little wonder that we see this drain from agriculture into industry. If industry is going to pursue this course what incentive is agriculture going to provide?

It used to be that a man could go on a farm and with his earnings get a start there. It looks now that if we are going to get anybody to start on the farm we are going to take them out of industry. You men are right in the throes of this kind of thing. We are all living with it, and the demand for parity prices is sponsored to a certain degree by this situation.

As an agricultural group we are going to have to take a good look at ourselves and decide what some of the answers are. Farmers are asking for such things as marketing boards. In asking for marketing boards they are asking practically the same thing the labourer is asking of the union. I don't know if that is the answer but I do say that the farmer has a right to try it if the other fellow has.

The important thing, however, may be that we have passed over a period of great prosperity. If we are going into a period of recession and you are faced with the situation of no seed and feed, no money for taxes, no implement bills paid, and debts beyond the capacity of the farmer to overtake or to pay the interest due, are we going to run away from this man and fraternize with the man who has been able to survive? How are you going to deal with the situation? When we get our people in that position we are going to have a far different attitude towards district agriculturists. If that time comes I hope that we shall be able to do a better job than we have ever done in the past.

Man's extremity in agriculture must be considered our opportunity. Our place in this province is going to be determined by our ability to measure up to this situation. I don't think that you have had the required tools in the past but we are making progress. You are the purveyors of scientific information, of knowledge, but sometimes other things than knowledge are needed.

To those living near the Special Areas, I might say that I have a special interest in that development. In 1931 I was asked to make a report on which the special areas north of the Red Deer River were initiated. There were no taxes coming in, municipalities and schools could not function, and the farmers could not survive.

That program was initiated by the Department of Agriculture, but once it was initiated the Department of Agriculture dropped out and administration was taken over by other departments. We are now asked to come back and assume certain responsibilities. To do this we must have the tools. We must have something better than talk. A man is not in a position to pay attention to improved farm practices when he is faced with loss of his farm.

People want to own land, but the question is "Are marginal lands worth anything?" What we need is a form of land tenure that you can offer to these people. For these people who get themselves into difficulties because of land commitments we have to find some alternative. We hope that if we have a depression we will have better tools to meet the situation, but if you have better tools you will have more responsibilities. Balanced farming is a good program but we have to support it with something more than mere advice. The function of the Department of Agriculture is to give people leadership and to provide them with ways and means of solving their problems.

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CONFIDENTIAL

CONTENTS

AGRICULTURAL CONFERENCE

January 10, 11, 12, 1955

DEPARTMENT POLICIES

LIVE STOCK
W.H.T. Mead

Cattle

The question of quality in live stock ties up with better farming and our main problem is to get our assistance applied where it is going to do the job we want it to do. There is no doubt about the vast improvement in cattle quality that has occurred over the last ten years, during which between six and seven thousand bulls have been distributed through the policy.

For the past two years our cattle policy has been operating on the basis of farm-to-farm transactions. It has just about doubled the number of individuals who received financial assistance, which would indicate to some extent that many people in previous years were not prepared to place an order for a bull and wait for what they got. People making selections in local herds are doing a good job. We have placed twice as many bulls as ever before, but whether or not it has done twice as much good is questionable.

In 1954 a higher percentage of our bulls was placed through the Department and a smaller percentage from farm-to-farm transactions than the year before. Another point that concerns us about the bull policy is its relationship to the consignment sales that are held in the province. The increase in these consignment sales has had a tremendous influence on distribution of breeding stock and improvement of our live stock.

With respect to dairy calves, we have placed in the last year 238 calves, which is about 75 more than in any other year.

Swine

Last fall we made a special effort to bring the question of swine quality to the fore. There are times when we must apply more pressure to certain parts of the industry than to others. It is no particular credit to this province to be one of the low provinces with respect to swine quality.

Assistance towards boar purchase, bonus on AR sows and get-of-sire competitions were some of the suggestions outlined by Mr. Mead. It was hoped that the prize money suggested would act as an incentive to swine improvement. This was questioned in principle by some of the men and some thought that the prize should be for progress from year to year as reflected in improved quality. It was suggested that prize money should be earmarked for the purchase of breeding stock.

It was pointed out that young pigs consigned for A.R. testing at $12.00 each would bring appreciably more than this on the open market and that this was a factor in breeders not entering this program. Some questioned whether this was the reason for not testing or whether it was fear of the breeder that the sow would not qualify.

It was suggested that the matter of A.R. would be more appropriately discussed by the Swine Breeders' Association but it was not believed by some that this could safely be left in their hands if action were hoped for. It was suggested that the premium commanded by A.R. breeding should be sufficient to offset the loss of the breeder in consigning his pigs. Mr. Charnetski did not agree.

Some believed that the price spread between grades was the most

important, if not the only real incentive for improvement. Others thought that there might be a certificate for any swine producer who reached a certain percentage of A grade hogs marketed. It was further suggested that based on market hogs the principle of the seed survey might be applied, with the information being returned to the breeders and perhaps publicized. Mr. Longman felt that the matter was important and that since we were now subsidizing cattle sires to some extent, perhaps swine raisers are entitled to the same consideration. The meeting generally was in favor of the proposal to subsidize A.R. sows, and in agreement with the principle of a get-of-sire competition. Also in favor of subsidizing the purchase of good quality boars through public sales.

FIELD CROPS
A.M. Wilson

Crops are basic to farming, including live stock. The September frost had a devastating effect on many parts of the Province but particularly in those districts where farming was already on a marginal basis. Thirty-six thousand questionnaires were sent to municipalities and 9,000 returned. This should provide a fair sample of conditions. Government assistance policy has been based on the information returned in questionnaires. The Government has 100,000 bushel storage capacity and it will be possible to fill this with oats in a very short time. Requests for seed should be made now, not delayed until spring. We would like to know whether Service Boards and municipalities are taking steps to get these orders.

Germination of oats west of Calgary-Edmonton road is very bad. The barley and wheat situation is less serious. The Agricultural Relief Advances Act provides authority for assistance. The purpose of this Act is to guarantee loans made by municipalities to farmers. It does not provide for free seed and feed relief.

Replying to questions, Mr. Wilson advised that D.A.'s will be provided with listings of available seed grain; prices of oats should be about $1.35 delivered; municipalities can be required by the Department to take action where necessary; and where it is not possible to take security on land for assistance provided, liens can be taken on crop and chattels.

G.R. Sterling spoke of special agreements with Service Boards. He advised that although these agreements are not being stressed particularly, they are being used to encourage Service Boards to carry on special projects for agricultural improvement. He suggested that D.A.'s assess the situation if special projects seem advisable.

F.F. Parkinson advised that the Department may assist Service Boards to establish seed cleaning plants up to approximately one-third of the cost. The northern part of the province is fairly well served, he said, and the seed drill surveys indicate the value of these plants.

W. Lobay reported that a pest control officer may be employed by any municipality at a salary shareable by the district and the Government. Rats are known to have crossed the North Saskatchewan River. We are now experiencing the beginning of infestation of alfalfa weevil, Mr. Lobay said. This is not extensive, but is so far confined to the southern part of the province. No cultural control methods are known.

DAIRY BRANCH
D.H. McCallum

The Dairymen's Act, amended a year ago, provides that all milk processors must be licensed. Dairymen with insufficient volume should be warned against high cost equipment such as pasteurizers, etc. Probably needs a minimum of 350 quarts daily. The Department of Health will assist in promoting pasteurization within villages, etc. There has been a big increase in herds under the improvement plan. Now about 3,800 cows.

A new plan has been introduced in the Edmonton area in which a fieldman visits dairymen and gives service with respect to cow testing. It is considered that he is doing work that is not practical for a D.A. Dairy meetings and field days have not always been satisfactory and perhaps more advertising is necessary. The availability of Mr. Dixon may be somewhat restricted. It would appear that the purchase of dairy cows for farmers must be followed up with a program of encouragement in order to establish them as dairymen, and without such a program there may be a waste of time and effort.

Farm Cost Studies

We have conducted surveys on mixed farms and in canning crops. When we inquired what type of studies the D.A.'s wanted we only received about nine replies. Mr. McBain will be prepared to discuss the results at farm meetings and we are wondering whether more use might not be made of him We hope to publish results of the mixed farm study, which we think will form the basis of discussions for farm meetings. More use might also be made of the local dairy inspector.

Questioned as to a fair price for skim milk, Mr. McCallum advised that as much in cents per cwt. as tankage in dollars per ton has been suggested. 1,200 pounds of skim milk is equal to about 100 pounds of protein supplement. A question was also raised from the floor as to possibility of help for Mr. Dixon.

VETERINARY SERVICES
Dr. E.E. Ballantyne

Six hundred and eighteen thousand calves have been vaccinated in the last ten years. Alberta programs are meeting with favor outside of the Province. Surveys indicate appreciable reduction in abortion rates. Exemptions to regulations have been requested in commercial cattle for feeding. To grant this would complicate the administration and perhaps defeat the program.

Testing programs have been a factor in improving handling facilities for cattle.

Veterinarians and D.A.'s do not send in very good case histories when forwarding specimens to the laboratory. We handle more speimens than either Cornell or Guelph.

With reference to compulsory testing, Dr. Ballantyne remarked that it should originate from public demand rather than from too much encouragement by the D.A.

POULTRY BRANCH
R.H. McMillan

The poultry industry is quite sensitive to scientific advances. There have been great changes in marketing procedures which have affected production. Prices vary in the amount of about 15 cents for eggs between peak and low production periods. D.A.'s are requested to forward suggestions as to how market information may be given to producers.

In reply to a question as to the position of the D.A. with respect to hatcheries that default in quality or health, Mr. McMillan suggested that D.A.'s should advise the Poultry Branch of such incidents. Our only test is with respect to pullorum disease, he said, and in most cases the hatcherymen will agree to arbitration of Federal inspectors.

4-H CLUBS
G.S. Black

Beef Clubs

There is some indication of decrease in the number of beef clubs. Perhaps some calves are over-finished, others need more finish. Buyers would like to see generally more finish. The Department may have to give some thought to setting the itinerary for beef club achievement days and sales. The need for this is demonstrated particularly at Edmonton, where probably three sales will be held. It is possible that soliciting of buyers is being over-worked. In one case where calves were sold over the regular stockyard market the sale turned out very satisfactorily. The group selling of calves is working well in Saskatchewan and may have to be used here.

W.C. Gordon advised that if calves are to be group sold the judge should know this before completing his placing.

Swine Clubs

Seven of the projects now organized under 4-H may send representatives to National Competition. New swine club regulations provide now for four projects, any one of which may be selected for a club. There is presently no provision for a good husbandry award but this might be arranged if desired. Federal Department is prepared to co-operate by giving special scoring if hogs are properly marked and the grader advised.

Grain Clubs

It is important to know immediately what seed is required for clubs, especially oats.

SCIENTIFIC AND NEWS RELEASES

Discussion of these releases indicated general acceptance. For "Science and the Land", subject headings were suggested and provision of some form of index at the end of each year.

BALANCING THE EXTENSION PROGRAM

Opening the discussion, F.H. Newcombe suggested that a little more fore-season planning of the year's program would be beneficial. "The plan will of necessity be different in different districts",he said, "but what are we accomplishing? What are the frustrations in your attempts to do the job you think you should be doing? Do you feel that you are doing more small chores than you should have to do?"

It was questioned as to whether the time spent on farm labour contributed much to the D.A. program. It took a great deal of time in some cases. On a show of hands 25 per cent were of the opinion that the farm labour program interfered with rather than contributed to the work of the D.A.

On the subject of 4-H clubs, W. Pidruchney thought that we could not entirely eliminate our work with these groups. In his area more than club members attend the meetings. "We are now reaching the stage", he said, "where we are using our earlier club members as leaders". F. Bell agreed that 4-H clubs are useful in developing leadership in a community, and believed that he was reaching more people through 4-H activities than in many ways.

S.S. Graham thought that rather than approach parents through the 4-H groups, a good job could well be done by getting at the parents directly. The farm planning program might be used for this purpose and the 4-H work

done in connection with farm planning. "Make your 4-H work complementary to the other work you are doing", he suggested.

Mr. Graham also mentioned the trend during the past few years of fewer farm visits in favour of office calls. "I don't think you can do your best work from the office, the telephone or the public meeting", he said. "I think you have to serve certain of your farmers right on the farm, discussing the farmer's problems on his own ground and on his own terms". "What would be the attitude of the Department towards definite days out in the field and others in the office?" queried H. Fulcher.

At the end of the discussion, Dr. Longman mentioned the need to guard against any feeling that certain jobs are beneath one's dignity. "If university training is going to mean anything in Canada, it must get back to where it will benefit the ordinary man", he warned. "No one should feel that by virtue of his university training any of this work is below his dignity".

MASTER FARM FAMILY PROGRAM

Mr. Newcombe pointed out that in the Master Farm Family program two main thoughts were kept in mind: recognition of a contribution to the community, and encouragement for improvement in others. Asked how many considered the first of greater emphasis than the second, the majority considered that recognition of a job well done was the chief benefit. Very few thought that it was changing the behaviour of people to any extent, although several indicated that they had received enquiries from young people as to requirements for the Master Farm Family award.

TRIBUTE TO THE DISTRICT HOME ECONOMIST
Honourable L.C. Halmrast

It is a pleasure to be here and to have this opportunity of spending a few minutes with you. I know that our farm people throughout the province, women expecially, do appreciate the work you are doing.

The farm wife remains in her home most of the time and sometimes does not see too much need of change. When you girls call in a community, especially in the farm home, you often suggest changes to make the home more pleasant. These people have indicated that they do appreciate the work you are doing, and I commend you for doing a good job.

CO-ORDINATION OF THE D.A. - D.H.E. PROGRAMS

The meeting of the district agriculturists and home economists was thoroughly appreciated by all present and discussion of how best to work together for the common good developed freely. One of the difficulties arises from the large size of the home economists territory and her need to concentrate, particularly in the beginning, on certain areas.

Some of the D.A.'s thought that arrangements for a day or so a week at the office of the district agriculturist would do much to tie in the combined program. There seemed to be some difficulty about this, however, again as a result of the special problems and large territory of the home economist.

A suggestion that the D.A. in the course of his visits might be on the watch for things in the farm home that might give the home economist a contact in that home did not meet with particular favour. It was argued that the home economists now have far more home visits than they can handle and unless a definite project could be arranged they did not want too many suggestions of that kind.

It was suggested that a preliminary meeting such as this at the beginning of the season followed by periodic meetings of agriculturists and home economists in the district might prove useful. This present meeting

provided an excellent opportunity for discussion of points of view and details of work and by the end of the meeting there was already a better understanding of each others problems and a definite desire to do everything possible to co-ordinate the programs.

THE FUNCTIONS OF THE WATER RESOURCES OFFICE
F.L. Grindley

Under the provisions of the Water Resources Act any person who wishes to utilize water for any purpose other than riparian use must apply to the Water Resources Office for authority to divert water.

Permanent records and plans are kept of all water diversions and any problems arising in connection with the allocations are looked after by the Water Resources Office.

Applications for the use of water have precedence according to the respective dates of filing, subject however, to precedence for the following purposes:

1. Domestic
2. Municipal
3. Industrial
4. Irrigation
5. Water Power
6. Other Purposes (Recreation, Wild life, maintenance, etc.)

Some of the projects authorized under the Water Resources Act entail more than one of the above phases of the use of water. But in a general way the importance of the uses of water must be considered in relation to this listing.

Each authorization for the use of water entails an inventory of the total amount of water to be diverted as well as the rates of flow. General and detailed plans must be filed and each application receive study not only in relation to the validity of the application but also in relation to the total available supply. Each application receives a number on the particular stream or tributary on which it is located and also a number under the primary drainage basin.

It will be apparent from the above that actual quantities of water are involved and this entails hydrometric data. The Department of Water Resources co-operates with the Dominion Government on securing this measurement data.

The Irrigation Districts Act and the Drainage Districts Act are off-shoots of the Water Resources Act. Briefly stated the irrigation and drainage acts provide for the setting up of self-governing organizations to administer the affairs of the districts after they have received approval under the general provisions of the Water Resources Act.

The practices of irrigation are as old as civilization itself and the merits of this use of water need not be dwelled on in this discussion.

Drainage of land has been effected by one or more of the following methods:

(1) Common Law Drainage:

An innumerable number of small farm ditches have been built by individuals to improve their lands and these operations have for the most part gone unchallenged.

(2) Municipal Road Drainage

(3) Highway Drainage

(4) Dominion Reclamation Act (Homestead drainage)

(5) The Private Ditches Act (small drainage developments)

(6) The Drainage Districts Act - Large areas requiring drainage are legalized under this Act.

Water Power: is still administered under the Dominion Water Power Act and its regulations. Developments to date are practically all on the Bow River and its tributaries, (Calgary Power) but studies are being made for the development of water power on the North Saskatchewan and Athabaska Rivers.

Many disputes and problems naturally arise over the use or misuse of water and the Water Resources Office employs hydraulic engineers whose duty it is to reconcile these problems.

Engineers of the Water Resources Office construct projects when it is in the public interest to do so. These projects involve drainage, irrigation, water supply, river control and erosion control.

Some of our rivers are international in character (Milk, St. Mary, Waterton, Belly, etc). Others are interprovincial (Saskatchewan).

Problems arise in connection with all allocations of water on these streams and these problems are dealt with by the Water Resources Office.

Under the Ground Water Control Act the matters of adequate control to prevent wastage and the recording of data on water wells are handled.

Briefly stated the above represents in a general way the functions of the Water Resources Office. Because the Province of Alberta is a watershed area and because the climate varies markedly from north to south there are many and varied problems in connection with the use of water in so vast an area.